This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{193600}{484}}$$

The solution is Whole, which is option A.

A. Whole

* This is the correct option!

B. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

C. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

D. Irrational

These cannot be written as a fraction of Integers.

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 440.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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2. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-4 + 5i)(-3 - 10i)$$

The solution is $62 + 25i$, which is option D.

A. $a \in [-42, -35]$ and $b \in [55, 58]$

$-38 + 55i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-42, -35]$ and $b \in [-57, -53]$

$-38 - 55i$, which corresponds to adding a minus sign in the second term.

C. $a \in [12, 14]$ and $b \in [-52, -47]$

$12 - 50i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

D. $a \in [58, 63]$ and $b \in [24, 30]$

* $62 + 25i$, which is the correct option.

E. $a \in [58, 63]$ and $b \in [-31, -19]$

$62 - 25i$, which corresponds to adding a minus sign in both terms.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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3. Simplify the expression below and choose the interval the simplification is contained within.

$$6 - 1^2 + 3 \div 20 * 5 \div 10$$

The solution is 5.075, which is option D.

A. $[7, 7.04]$

7.003, which corresponds to two Order of Operations errors.

B. $[7.07, 7.09]$

7.075, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

C. $[4.97, 5.02]$

5.003, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[5.07, 5.09]$

* 5.075, this is the correct option

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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4. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-780}{6}}i + \sqrt{143}i$$

The solution is Nonreal Complex, which is option E.

A. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

B. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

C. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

E. Nonreal Complex

* This is the correct option!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-4 + 9i)(6 - 3i)$$

The solution is $3 + 66i$, which is option A.

A. $a \in [-2, 4]$ and $b \in [65, 68]$

* $3 + 66i$, which is the correct option.

B. $a \in [-26, -23]$ and $b \in [-33, -25]$

$-24 - 27i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

C. $a \in [-52, -50]$ and $b \in [-43, -41]$

$-51 - 42i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-2, 4]$ and $b \in [-71, -61]$

$3 - 66i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-52, -50]$ and $b \in [42, 49]$

$-51 + 42i$, which corresponds to adding a minus sign in the second term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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6. Simplify the expression below and choose the interval the simplification is contained within.

$$16 - 8 \div 6 * 9 - (18 * 20)$$

The solution is -356.000, which is option C.

A. $[-344.15, -341.15]$

-344.148, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[370.85, 377.85]$

375.852, which corresponds to not distributing addition and subtraction correctly.

C. $[-357, -353]$

* -356.000, which is the correct option.

D. $[-288, -276]$

-280.000, which corresponds to not distributing a negative correctly.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{9 - 77i}{6 - 4i}$$

The solution is $6.96 - 8.19i$, which is option B.

A. $a \in [-6.5, -4.5]$ and $b \in [-10, -9]$

$-4.88 - 9.58i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [6.5, 7.5]$ and $b \in [-8.5, -7]$

* $6.96 - 8.19i$, which is the correct option.

C. $a \in [6.5, 7.5]$ and $b \in [-426.5, -425]$

$6.96 - 426.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [0, 2.5]$ and $b \in [18, 20]$

$1.50 + 19.25i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [361.5, 363]$ and $b \in [-8.5, -7]$

$362.00 - 8.19i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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8. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-990}{9}}i + \sqrt{165}i$$

The solution is Nonreal Complex, which is option D.

A. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

B. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

C. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

D. Nonreal Complex

* This is the correct option!

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{54 + 55i}{-1 + 8i}$$

The solution is $5.94 - 7.49i$, which is option A.

A. $a \in [5, 6.5]$ and $b \in [-8.5, -7]$

* $5.94 - 7.49i$, which is the correct option.

B. $a \in [-54.5, -53]$ and $b \in [6, 7.5]$

$-54.00 + 6.88i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-8.5, -7]$ and $b \in [5, 6.5]$

$-7.60 + 5.80i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [385, 386.5]$ and $b \in [-8.5, -7]$

$386.00 - 7.49i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [5, 6.5]$ and $b \in [-487.5, -486]$

$5.94 - 487.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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10. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{42849}{529}}$$

The solution is Integer, which is option D.

A. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

B. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

C. Irrational

These cannot be written as a fraction of Integers.

D. Integer

* This is the correct option!

E. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -207.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.
